

[COMMUNICATION]

**Colony Composition of the Wood-feeding Cockroach,
Panesthia australis Brunner (Blattaria, Blaberidae,
Panesthiinae) in Australia**

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ABSTRACT—The wood-feeding and subsocial cockroach, *Panesthia australis* was investigated with special reference to colony composition in the eucalypt forests in New South Wales, Australia in October 1986. Twenty seven adults and 185 nymphs were collected in the study areas. The field evidence presented here shows that this cockroach lives in the family groups and the intimate adult-offspring relationships may continue for a long time.

INTRODUCTION

The order Blattaria is of special interest in discussion of the evolution of eusociality in Isoptera, it is regarded as a modified side branch of the latter. Of the 4000 species of cockroaches in the world, a wood-roach, *Cryptocercus punctulatus* (Cryptocercidae) is believed to be in the position nearest to the lower termites in phylogenetic relationship [1, 2]. There are some morphological similarities between them, and the wood-roach's hindgut fauna of symbiotic cellulose digesting Protozoa closely resembles those of lower termites. The wood roach lives in monogamous pairs or in intimate family groups. It dwells in the rotting wood of fallen logs and is frequently mentioned in discussions of the origins of termite sociality [3-5]. Besides *Cryptocercus*, some other blaberid genera (e.g. *Panesthia* and *Salganea*) of the Panesthiinae are also known as wood-dwelling and wood-feeding roaches that live in family

groups [6, 7]. The life history characteristics of only a few Australian species of the genus *Panesthia* have so far been reported and available information are still fragmentary. According to Shaw [8] both *Panesthia australis* and *P. laeivollis* appear to live in families, and that one usually finds a pair of adults often associated with from 12 to 20 nymphs in different stages of development (see also Tillyard [9]). The Panesthiinae occurs principally in the Indo-Malayan and Australian regions with a few extending into the Palaearctic region having ten genera [10]. In Australia the subfamily is represented by seven genera and largely restricted to the eastern part of the continent.

In 1986, I had an opportunity to study some wood roaches in New South Wales Queensland. This paper reports the colony composition and some life history characteristics of one species, *Panesthia australis* Brunner.

STUDY SITE AND METHOD

Social groups of *P. australis* were collected from rotten logs in eucalypt forests along road from Braiwood to Batemans Bay in New South Wales. Logs were inspected for evidence of roach activity, and if entry holes were present, the course of the irregularly-shaped gallery were traced with a chisel hammer until the end points of the gallery system were reached. All roaches in one gallery system were considered to be members of a social unit. Logs larger than 30 cm in diameter were not

inspected because preliminary check showed that numerous and complex gallery systems made it difficult to discern the limits of individual social units. The gallery systems of families with small

nymphs were shorter and simpler than those of families with larger nymphs. The wall of galleries are built out of frass, and many frasses also were deposited in or near entrances of a gallery. The

TABLE 1. Group composition and size distribution of *Panesthia australis* in October 1986. (Figures indicate number of individuals)

Presence of adults		Number of nymphs by size class (body length, mm)														Total Type of number group			
♀	♂	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6			
+	+					2	1			1	4	1		1	3	1	16	A	
+	+												2	1		1	6	A	
+	-										2	4		8	2	7	24	B	
+	-									1	1				9	1	7	13	B
+	-					1			2	1	3	1		2			11	B	
+	-							1					4	5			11	B	
+	-						1	2	1	2	1	1					10	B	
+	-										1	1			2	4	9	B	
+	-		1				1	1	3			1	1				9	B	
+	-	1	1	1			1			1							6	B	
+	-	1				1							2			1	6	B	
+	-									2	2	1					6	B	
+	-			1	1								1	1			5	B	
+	-		1					1				1					4	B	
+	-													3			4	B	
+	-						1		1								3	B	
-	+	1	1														3	C	
-	+												1				2	C	
-	-				1	1	1	2	1	2				1			9	D	
-	-				1	1	1	3									6	D	
-	-										2	2			2		6	D	
-	-									2	1	1	1				5	D	
-	-					1	1	1	1	1							4	D	
-	-	1		1		1											3	D	
-	-		2	1													3	D	
-	-								1					2			3	D	
-	-		1	1													2	D	
+	+																2	E	
+	+																2	E	

- A: families with an adult pair and nymphs
- B: families consisting of a group of nymphs together with an adult female
- C: families consisting of a group of nymphs together with an adult male
- D: groups of nymphs
- E: adult pairs

numbers of adults and nymphs were counted and their sizes were measured by using calipers. *P. australis* adults are about 34 mm long and black in color. The tegmina and wings are fully developed but they are dropped after the pair formation. As the sexual dimorphism is negligible in size and shape, sex of adults were determined by inspection of external genitalia. As *P. australis* is ovoviviparous, the number of nymphs (clutch size) in uterus could be determined by dissection of adult females. The number of nymphal instars, and time required for nymphal development, are unknown.

RESULTS AND DISCUSSION

Forty eight social units (27 individuals of adults and 185 individuals of nymphs) were collected in the study areas. Table 1 summarises the composition of *P. australis* social units found in October 1986. Besides 3 solitary females I could classify 29 groups into 5 types (A–E). This means most individuals belonged to 'family' in a wide sense. Families consisting of a group of nymphs together with an adult female (type B) comprised 29.1 % of the total social units (51.9 % of total number of adults, i.e. 14/27). Families with a male adult and nymphs (type C) or families with an adult pair and nymphs (type A) were fewer than type B families. Table 1 also shows the size distribution of nymphs in 'family' groups, i.e. family groups (type A–C) and groups of nymphs (type D). Overall mean brood sizes (number of nymphs) of family groups were 7.1 ($n=18$, $SD=5.3$). Total number of nymphs in 'family' type (A–D) was 169 and mean body length was 16.7 mm ($SD=7.8$ mm, range=7–35 mm).

Besides family groups, I collected 16 individuals of solitary nymphs and their mean body length was 23.4 mm ($SD=6.6$, range=15–35 mm). This suggested that small nymphs less than 15 mm body length do not disperse from groups or they could not live alone. The nymphs within some families were not similar in size and color. As the growth rate of cockroaches is known to be quite slow, these families possibly contained two or three broods. For example, one of type B groups had older nymphs (ca. 26 mm) and younger nymphs (ca. 11 mm). This also means that adult-offspring

relationship might continue for long time. Thus, it can be said that *P. australis* is a subsocial wood roach in a wide sense. Mean clutch size of dissected female was 15.7 ($n=4$, $SD=1.5$, range=14–18). The clutch size of *P. australis* was lower than that of *Cryptocercus punctulatus* (Nalepa 1984; $n=33$, mean size=22.7, $SD=10.8$, range=4–42) [5].

The genus *Cryptocercus* was placed near or in the Panesthiinae (or Panesthiidae) by many earlier taxonomists. However, McKittrick [1] revealed that the resemblance of some panesthiines to *Cryptocercus* is due to convergence, and they are belonged to different superfamilies (Blaberoidea and Blattoidea). She concluded that there are two phyletic lineages, one of which evolved ovoviviparity (Blaberoidea) and the other remained oviparous (Blattoidea). The Panesthiinae are all ovoviviparous and are placed in Blaberoidea. The ovoviviparous cockroaches (Blaberidae) are frequently subsocial and associations of adults and young nymphs in 11 genera have been observed in the field or in laboratory colonies [9]. But in most cases, the associations are those between mother and her offspring, not between an adult pair and their offspring, and the intimate mother-offspring relationship continues usually for a short time as aggregation of newly hatched offspring around their mother [10]. The family groups which continue for a long time as in *Panesthia* ([7] and the present paper) and *C. punctulatus* [4, 5] are so far not well-known. The adaptive value, especially from a sociobiological perspective, of a lasting-family formation in wood-feeding cockroaches has still to be considered.

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